

Mapping the Relationship Between Wildfire and Poverty

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Abstract—Wildfires and related government roles and responsibilities for federal wildland management are prominent in our national consciousness because of the increased severity in the last decade of fires on and around public lands. In recent years, laws, strategies, and implementation documents have been issued to direct federal efforts for wildfire prevention, firefighting, and recovery. Reliable national-level information and monitoring are essential to ensure good decision-making and agency accountability. Social and economic information about communities at risk from wildfire is critical to these decisions. Despite the indispensable nature of this information for understanding communities, wildfire risk, and cooperative efforts, there is a void in policy direction within the federal agencies to collect, understand, and use social and economic information in wildfire management programs. This study addresses community capacity and examines socioeconomic indicators as elements of wildfire risk. The study investigates whether communities most at risk from wildfire are able to access and benefit from federal programs established to serve these communities. In other words, are the dollars, assistance, and fuels-reduction projects hitting the ground in the areas throughout the country that are most at risk to wildfire? This presentation will provide a forum to discuss the needs of rural and underserved communities in relationship to fire and fuels management programs.

Introduction

Wildfires and the related government roles and responsibilities for federal wildland management are prominent in our national consciousness because of the increased severity in the last decade of fires on and around public lands. In recent years, numerous laws, strategies, and implementation documents have been issued to direct federal efforts for wildfire prevention, firefighting, and recovery. Reliable national-level information and monitoring are essential to ensure good decision-making and agency accountability.

Social and economic information about communities at risk from wildfire is critical to these decisions. Despite the indispensable nature of this information for understanding communities, wildfire risk, and cooperative efforts, there is a void in policy direction within the federal agencies to collect, understand, and utilize social and economic information in wildfire management programs.

This research project uses the concept of community capacity – a community's ability to protect itself, respond to, and recover from wildfire – and examines socioeconomic indicators (one component of community capacity) as elements of wildfire risk. Utilizing socioeconomic information, as well as ecological factors, this study set out to investigate, through a geographical-information-systems approach, whether communities most at risk from

In: Andrews, Patricia L.; Butler, Bret W., comps. 2006. Fuels Management—How to Measure Success: Conference Proceedings. 28-30 March 2006; Portland, OR. Proceedings RMRS-P-41. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

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wildfire are able to access and benefit from federal programs established to serve these communities. In other words, are the dollars, assistance, and fuels-reduction projects hitting the ground in the areas throughout the country that are most at risk?

This research project found that federal agencies do not have the information and data necessary to answer this question. Spatial data to inform every aspect of this research – including data regarding the ecological conditions of federal lands, wildfire protection capability in and around communities, and the federal expenditures under the national fire plan – are unavailable and/or inadequate.

Using the limited data that are currently available, this research focused primarily on the relationship between poverty and populated areas at risk to wildfire. Our research indicates that there is a relationship between poverty and federal land ownership, and that more poor households are located in close proximity to federal lands. Perhaps more significant, the research shows a higher percentage of poor households in inhabited wildland areas that are not considered part of the Wildland Urban Interface – the areas that federal agencies and Congress have prioritized to receive the majority of funds for activities under the national fire plan. The research also indicates that, in the one state analyzed, poor households are more likely in areas with low or no fire response capabilities than are non poor households.

This research should be seen as a first step to document the importance of social and economic information and community capacity in wildfire policy and implementation. The lack of information about wildfire risk, including ecological conditions, socioeconomic indicators, and resource allocation convinced us to focus our recommendations on improving federal agency understanding and use of social and economic factors through national inventory and monitoring efforts. Specific recommendations include developing a method for measuring community capacity in the context of wildfire and using this methodology to redefine the concept of risk for implementation priorities at the national level and in state, regional, and local planning and risk assessment. Federal land management agencies must also improve systems for monitoring national fire plan expenditures and the datasets that support the prioritization of these funds.

Understanding the social and economic dynamics of communities is critical for providing federal assistance that will help communities protect themselves from wildfire and respond to and recover from an event. We encourage others to build on this effort to understand the complex social, economic, and ecological factors that influence wildfire risk. Specifically, we encourage federal agencies to take steps to understand the social and economic indicators that are necessary to understand and serve our nation's communities.

Research Methods

This study examines the relationship between wildfire and community risk through the concept of community capacity. The research also attempted to analyze federal resource allocation in conjunction with data indicating relative risk. To examine these issues, the project team conducted background research to identify indicators and nationally consistent data for each element of the project. The team also facilitated internal and external data review, mapped indicators once data had been collected, and reexamined and reported findings through the mapping process.

To illustrate the study elements, we sought data to use as indicators of community capacity and wildfire risk. This process was iterative, investigating potential datasets, summarizing the benefits and drawbacks of each, and obtaining feedback from an advisory committee. We also presented preliminary findings of the study at two community meetings in southern Oregon and central Oregon.

This section provides a description of the data we initially sought to examine community capacity, wildfire risk, and federal resource allocation. It includes the limitations of the best available data, and a summary of how we use the data in this study.

National-Level Data

This report is a national-level analysis that seeks to provide information on a national scale. The spatial information included in this report is provided at the county and census-block levels. Therefore, the visual analysis is, in many cases, more meaningful on a state level. Consequently, the researchers have included more detailed maps and analysis for the states of Washington and Oregon, as state-level examples. The maps and analysis shown for these two states are also available, upon request, for other states.

Identifying indicators that provide consistent and meaningful information for a nationwide study became the first challenge. Although some poverty data exist on a national scale (from the Census and Department of Housing and Urban Development), it was more difficult to find consistent national data on community capacity, protection capacity, wildfire risk, and federal resource allocation. The researchers encountered major challenges in finding spatial data, especially in a format conducive to national-level modeling. Specifically, there is a lack of suitable data in the areas of: (1) community capacity/protection capability (2) ecological conditions on federal lands/populated areas at risk from wildfire; and, (3) federal resource allocation.

Indicators and Data

The following section provides information about the purpose of each indicator, the data initially sought, the limitations encountered, and the data ultimately selected.

Community Capacity

Examining community capacity requires understanding a complex set of issues and indicators that are not easily summarized by a single set of data. Below, we explain the purpose for using the concept of community capacity, existing definitions of community capacity found in published research, the limitations we encountered in identifying data, and the indicators we ultimately chose for this research.

Community capacity can be used to assess the relative risk that a community faces from wildfire. Well defined, community capacity will provide the social information to tell us which communities are at a greater risk—less ready to protect themselves from wildfire, and less able to recover from the impacts of a fire. Understanding the capacity of a community to address the economic, social, and environmental costs of wildfire will lead to more directed policies and programs and a more efficient use of resources. Following are two definitions of capacity that we used to help frame the study and the indicators we sought to use for the research.

- Kusel (1996) defines community capacity as “the collective ability of residents to respond...to external and internal stresses; to create and take advantage of opportunities; and to meet the needs of residents, diversely defined.”
- A response by American Forests to the 2001 Federal Register notice *Urban Wildland Interface Communities within the Vicinity of Federal Lands that are at High Risk from Wildfire*, defines community capacity as the collective ability of residents in a community to respond to external and internal stresses, to create and take advantage of opportunities, and to meet local needs. Community capacity in relation to wildfire addresses a community’s ability to mitigate wildfire threats, respond to active wildfire, and mitigate post fire damage. This includes the ability to implement risk-reduction strategies, including hazardous fuels reduction, firefighting, and restoration activities (American Forests 2001).

For purposes of this research (and because of limited data), two indicators were used as a first step to measure community capacity as it relates to wildfire: (1) socioeconomic elements that influence a community’s ability to respond to and recover from wildfire and (2) protection capability - systems that are in place that influence a community’s ability to protect itself from an actual wildfire. As previously stated, a true assessment of community capacity would include a much broader array of social and cultural information; however, this information was not readily available at the time that this research was undertaken.

The study uses 2003 Housing and Urban Development (HUD) Income Limits, at a comparable census block group level, as the primary layer for poverty. HUD Income Limits reflect income, earnings and employment, and housing affordability. The Median Family Income Limit estimates are based on the U.S. Census Bureau median family income estimates with an adjustment using a combination of earnings and employment data, median family income data, and fair market rents. Data are available nationally. HUD Income Limits describe family sizes of one to eight persons, and a formula is provided to calculate income limits for larger family sizes. Income limits are adjusted for family size and areas with unusually high or low family income or housing-cost-to-income relationships (Housing and Urban Development). Income limit groups include families whose incomes do not exceed 80 percent of the median family income for the area (*low-income*), families whose incomes do not exceed 50 percent of the median family income for the area (*very low-income*), and families whose incomes do not exceed 30 percent of the area median income (*very, very low-income*).

This report also utilizes fire hazard ratings, used by both public and private sector organizations around the nation, as indicators of the capabilities of fire districts to protect their communities from wildfire. The Fire Suppression Rating Schedule is a common method used by the insurance industry in reviewing the firefighting capabilities of individual communities. The schedule measures the major elements of a community’s fire suppression system and develops a numerical grading called a “Public Protection Classification.” Ten percent of the overall grading is based on how well the fire department receives and dispatches fire alarms. Fifty percent of the overall grading is based on the number of engine companies and the amount of water a community needs to fight a fire. Forty percent of the grading is based on the community’s water supply, which focuses on whether the community has sufficient water supply for fire suppression beyond daily maximum consumption.

This report uses data from the Washington State Independent Fire Hazard Rating Bureau to assess the relationship between fire hazard ratings, poverty, and potential wildfire risk. The Washington State Rating Bureau provides data for all of the fire protection ratings for fire districts in Washington State.

Ecological Risk/ Populated Areas at Risk from Wildfire

The research intended initially to examine ecological wildfire risk—the likelihood of fire occurring in different areas and the potential damage such a fire would pose—through spatial data that would indicate, on a national level, the relative risk status of wildlands across the country. This indicator was intended to provide information about the ecological condition of lands. When it became apparent that there was insufficient consistent and up-to-date data on the ecological conditions of lands, we focused the study on the potential risk of fire to populated areas.

This study focuses on two distinct elements of the Forest Service study and data on wildland urban interface. The first data set that we examine is the *Wildland Urban Interface* as defined above. The second set of data that we use is the *Wildland Intermix*—less densely populated areas in wildlands, which enabled the study to include significant portions of inhabited land in areas vulnerable to wildfire.

Federal Resource Allocation

Initially, this study intended to include data detailing all federal expenditures under the National Fire Plan, including grants to communities and hazardous fuel reduction projects on private and public lands and spatial information that would indicate where the activities took place. These data would provide a roadmap to track where federal funding was being spent, which would allow researchers to examine these data with the data layers indicating capacity and wildfire risk. The combination of these layers would provide information about how well the federal agencies were serving the areas most at risk from wildfire.

National Fire Plan Grants—National Fire Plan data for Region 6 are available in a multi-agency database (projects funded by BLM, Bureau of Indian Affairs, USDA Forest Service, and Fish and Wildlife Service). They include zip code and latitude/longitude information for each grant, based on the location of the grant recipient, and a designation for the type of project funded (fuels reduction, fire prevention, planning and education, small-diameter marketing and utilization). Because of the limitations of the grants data, the decision was made not to analyze the data numerically. This report does include maps that illustrate the allocation of National Fire Plan Community Assistance grants in Oregon and Washington in comparison with poverty and WUI and Inhabited Wildland areas.

Findings

When we began this study, we anticipated that findings would focus on the provision of services (or gaps in services) to at-risk communities. Actual findings are considerably different from this original intent, due largely to the limited availability of data and lack of monitoring information.

Overall, the findings indicate that using national datasets to illustrate the complex social and ecological factors influencing wildfire risk is limited by the very nature of these elements. Datasets available for social, economic and ecological factors are more refined and meaningful on smaller scales. Locally specific data and information provide a better indication of the relationship between wildfire and poverty and how well services for fire protection are being provided to at-risk communities. This is apparent in the data we reviewed, as well as from comments from public meetings held in southwest and central Oregon and through dialogue with national partners. Despite these challenges, specific research findings include:

- 1) a slightly higher percentage of poor households in inhabited wildland areas that are not considered part of the WUI;
- 2) poor households in Washington State are more likely to be in areas with low or no fire response capabilities than are non poor households;
- 3) federal land management agency information about grants to communities and hazardous fuels reduction projects is insufficient to allow an analysis of areas served or improved.

The following section describes these findings in more detail.

Poverty and Wildland Urban Interface and Inhabited Wildland Areas

The first set of findings is related to the incidence of poverty in the wildland urban interface and other inhabited forested land areas. Initial analysis using the WUI dataset resulted in maps that showed a small portion of the total forested land area, particularly in the western United States. Further investigation indicated that the federally defined “*Wildland Urban Interface*” is based on residential density that excludes many inhabited forest areas. Expanding the analysis to include wildland intermix, the less densely populated areas that are not included in the WUI, which we refer to from here on as “*Inhabited Wildlands*,” allowed us to include significant portions of rural, inhabited land in areas vulnerable to wildfire.

Table 1 illustrates the percentage of households in Oregon, Washington, and nationally in WUI and Inhabited Wildland areas and compares non-poor, poor, and very poor households. These percentages illustrate a trend in the Northwest and nationally of a greater number of poverty areas in inhabited wildland areas than in the states or nation as a whole, or in WUI areas or non-forested areas.

Results from this analysis indicate that, in general, there are more households in poverty in inhabited wildland areas than there are in the Wildland Urban Interface or in areas outside of the vegetated wildlands in the rest of the state. The researchers held regional meetings to share preliminary findings with community organizations, agencies, and citizens in poor areas to examine data at a local level. These meetings reinforced the finding that the inhabited wildland areas that do not fall within the federal WUI definition are areas with a greater number of households in poverty.

Maps of Oregon, Washington, and the United States on the following pages illustrate the data described above and provide a visual representation of the relationship between wildfire and poverty. The maps illustrate HUD units where 20% of households or more are low-income households in Wildland Urban Interface and Inhabited Wildland areas.

The study maps of Oregon and Washington clearly indicate a tremendous amount of inhabited wildland, particularly in the western United States,

Table 1—Household Location by Poverty Level and Wildland Urban Interface Designation.

Income level	Location	Overall	Fire hazard Designation		Inhabited wildlands
			Not vegetated	WUI	
Non Poor	National	77%	79%	81%	76%
	Oregon	79%	78%	83%	77%
	Washington	79%	79%	83%	78%
Poor	National	23%	21%	19%	24%
	Oregon	21%	21%	17%	23%
	Washington	21%	21%	17%	22%
Very Poor	National	12%	10%	9%	12%
	Oregon	10%	10%	8%	11%
	Washington	11%	10%	8%	11%

that is not considered part of the WUI under the Federal Register definition (figures 1, 2, and 3). There is a relatively high level of poverty in the non-WUI rural areas (areas where the housing density is too low to be included in the WUI).

The maps of Oregon and Washington illustrate a strong relationship between poor areas and the communities in the Inhabited Wildland areas. The national numbers support this relationship as well. However, more detail is evident from the national map, which illustrates that, although there may be more poverty in the inhabited wildlands in some regions, such as the western United States, other regions may have more households in poverty in the WUI, as appears to be the case in the Southeast.

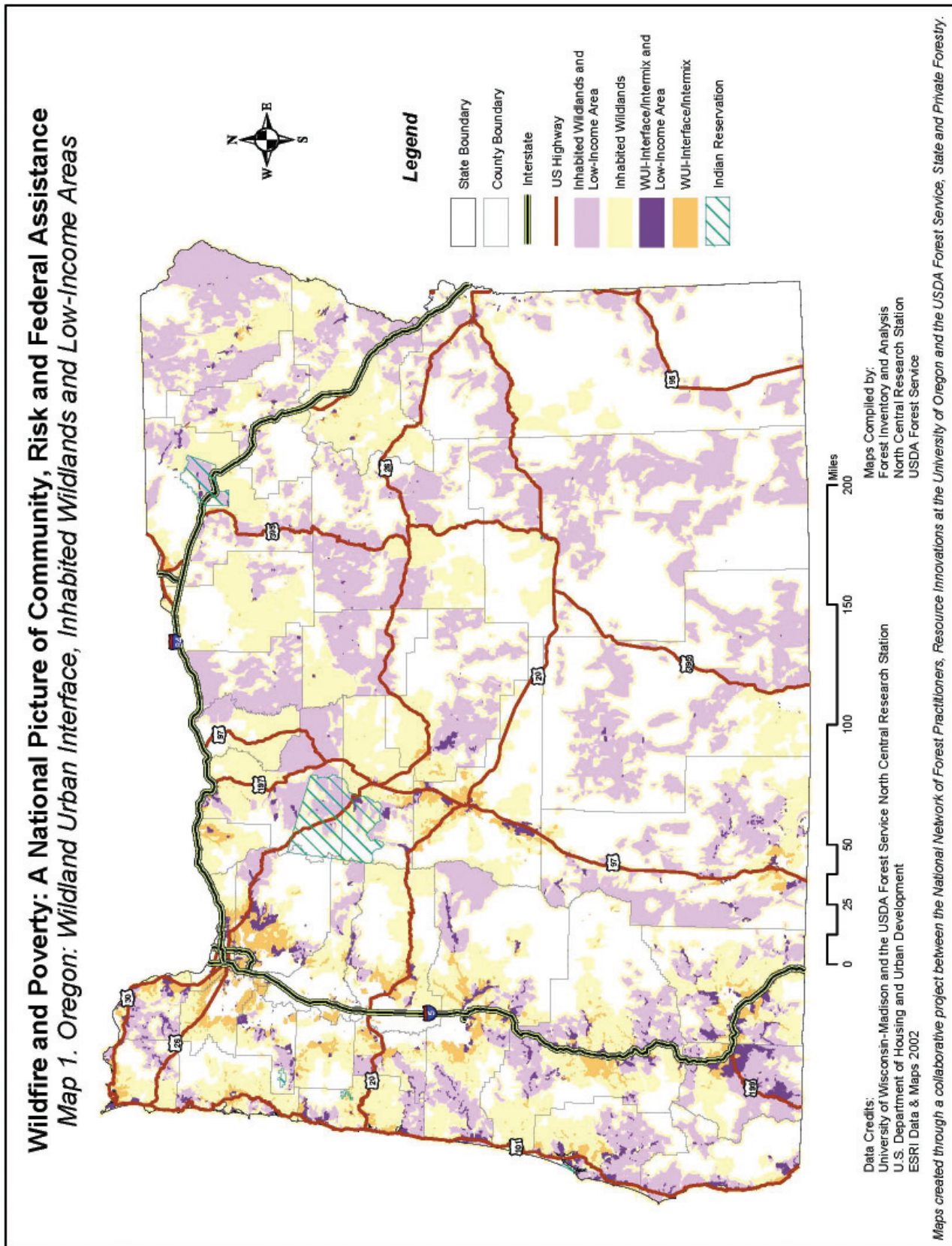
If agencies are following the Federal Register definition, the strategy to prioritize WUI lands for hazardous fuels reduction work and the funding reserved for those areas means that fewer resources are being allocated in some regions to the poorest citizens in communities that may need the most assistance.

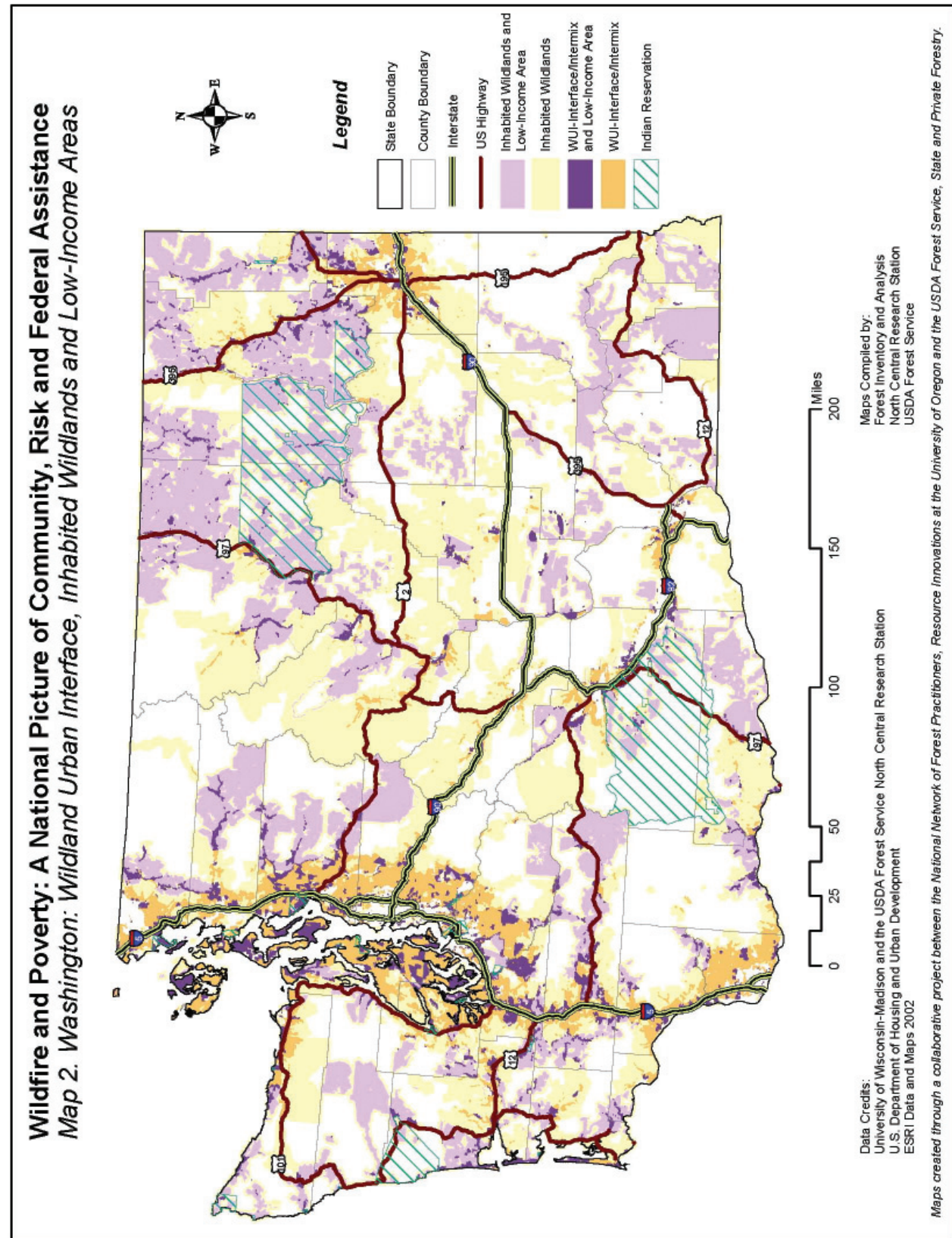
Poverty and Protection Capability

This study provides data about the level of fire district capabilities, which is only one indicator of the capacity of a community to reduce wildfire risk. This information is provided for the state of Washington.

Table 2 illustrates the percentage of poor and non-poor households in each of four fire response categories in Washington. A small area in the west-central portion of the state did not fall under a particular response category but showed that 33.1% of households are poor. Although there are low-income populations with all levels of fire protection, the map illustrates the visual relationship between the Wildland Urban Interface and Inhabited Wildland areas, as well as poverty and protection capability. In general, a higher percentage of poor households live in areas with no or low fire response capability than do non-poor households.

Figure 4 illustrates the level of fire protection capability in relation to the Wildland Urban Interface and poverty data in the state of Washington. The map shows a relationship between high poverty areas that overlap with areas with limited to no protection capability.





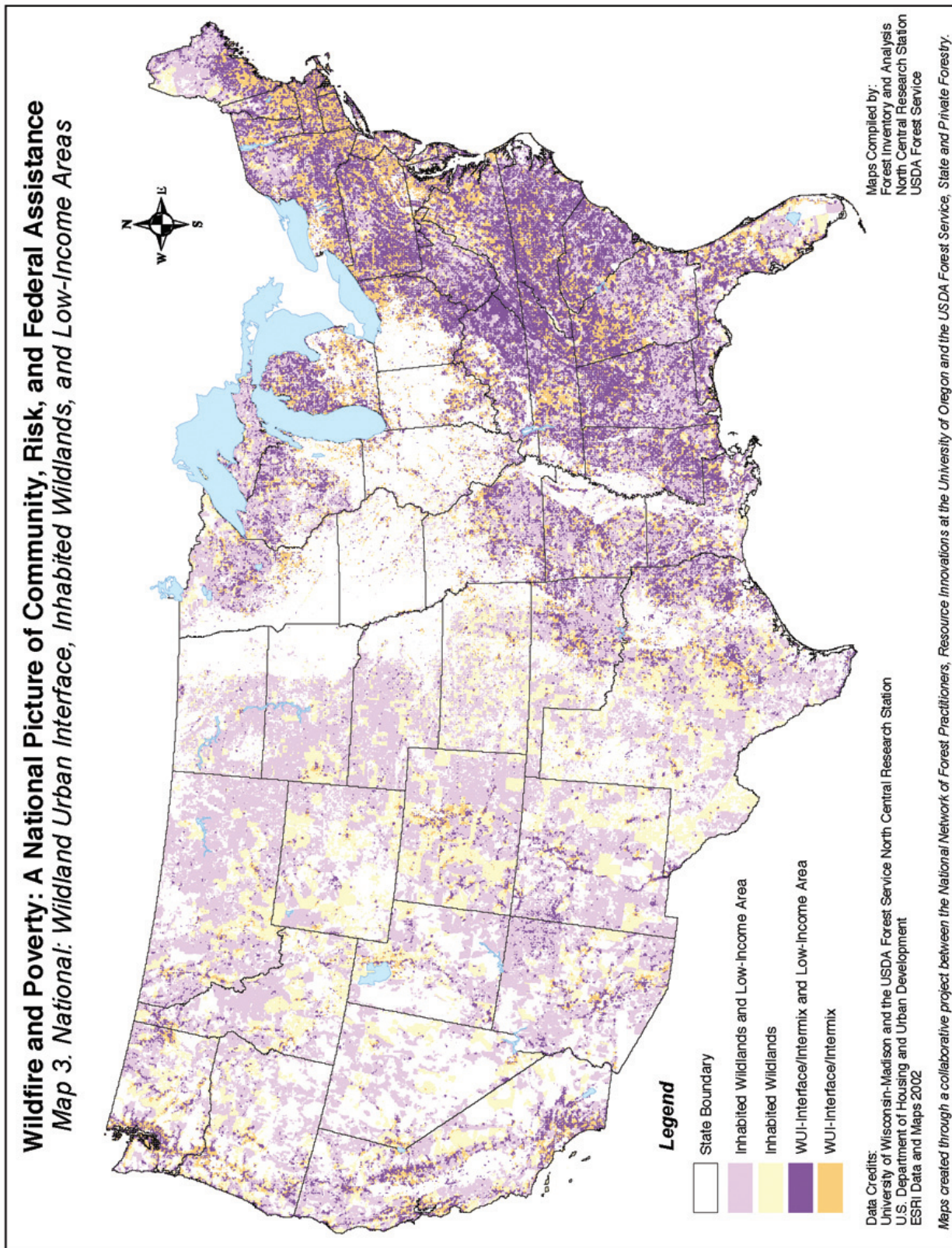
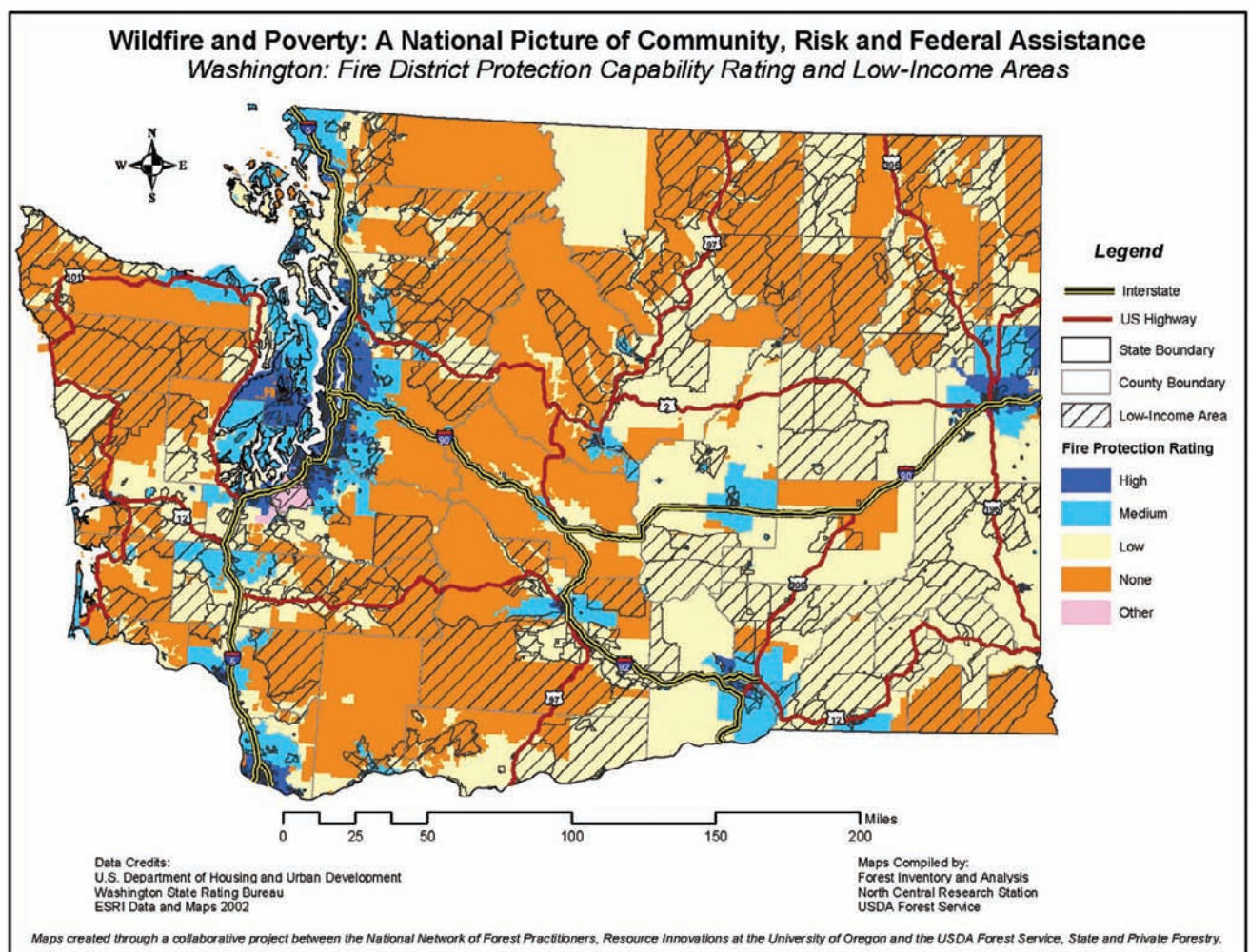


Figure 3—National: WUI, Inhabited Wildlands, and Low-Income Areas.

Table 2—Washington Households, Poverty Level and Fire Protection Capability.

Income Level	High Fire Response	Medium Fire Response	Low Fire Response	No Fire Response
Non-Poor	82%	85%	79%	77%
Poor	18%	16%	21%	23%
Very Poor	8%	7%	10%	12%

**Figure 4**—Washington: Fire District Rating and Low-Income Areas.

Federal Resource Allocation and Grants

The original goal of this study was to examine the provision of fire-related services and resources to low-income, low capacity communities in high-risk wildfire areas. Because of limited data about actual grant and resource allocation, it is not possible to draw reliable conclusions about resource allocation in and around poor communities. Consequently, our findings are limited to the discovery that there is inadequate monitoring of NFP expenditures and program implementation at the national level to ensure the accountability of federal programs to the goals and priorities set forth in the National Fire Plan, Healthy Forest Restoration Act, and related wildfire programs.

National Fire Plan Grants—Data about fire and aviation community assistance grants obtained through the National Fire Plan office in Region 6 (Oregon and Washington), produced maps that reflect areas that have received grants that relate to the poverty data in WUI and Inhabited Wildland areas.

The limitations of these data, as described in the research methods section, above, restricted our ability to provide percentages of poor communities that have received (or benefited from) National Fire Plan grants. The points on the map illustrate where grant funds have been received, not where grants were actually expended. In some cases, grants may have been received by agencies and organizations in county seats or municipalities that have higher income levels than the more rural areas where the funds were expended. The point data also lack information on the type and amount of treatment that occurred and the extent to which fire and fuel conditions, and community capacity have changed in low-income areas.

Recommendations

Due to the limited availability of data and the limitations of the existing data, we have focused our recommendations on improving federal agency understanding and use of social and economic factors through national inventory and monitoring efforts, and on increasing and improving assistance for low-income and low capacity communities. A summary of recommendations is provided below.

1. Redefine the areas prioritized for federal assistance to include rural areas with lower residential density (e.g., inhabited wildlands).
2. Improve systems for monitoring and evaluating the National Fire Plan and other federal fire-related program implementation by including social and economic, as well as ecological, information.
3. Immediately develop nationally consistent standards for monitoring National Fire Plan expenditures that will enable assessment of outcomes over time.
4. Develop a method for measuring community capacity in the context of wildfire.
5. Provide clear direction to federal and state land management agencies for determining “at risk” communities, giving significant consideration to social and economic factors. Target assistance and federal programs based on community needs.
6. Integrate indicators of community capacity into state, regional, and local planning and risk assessment.

7. Increase federal support and funding to programs that target assistance to “at risk” communities.
8. Conduct case studies in high wildfire risk areas to gain more in-depth knowledge about the relationship between wildfire, poverty and community capacity.

Acknowledgments

Several individuals were instrumental to this research. Special thanks to Dacia Meneguzzo and Ron McRoberts from the Forest Inventory and Analysis, North Central Research Station, USDA Forest Service. Dacia provided the mapping expertise and labor, and Ron provided knowledge and advice regarding spatial mapping and datasets. Krista Gebert, Rocky Mountain Research Station, USDA Forest Service and Susan Odell, National Rural Community Assistance Coordinator, USDA Forest Service bridged the gap between the authors and the Forest Service, providing support and assistance. Bonnie Wood and Lauren Maloney assisted in obtaining data about community assistance grants from the Region 6 National Fire Plan office.

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